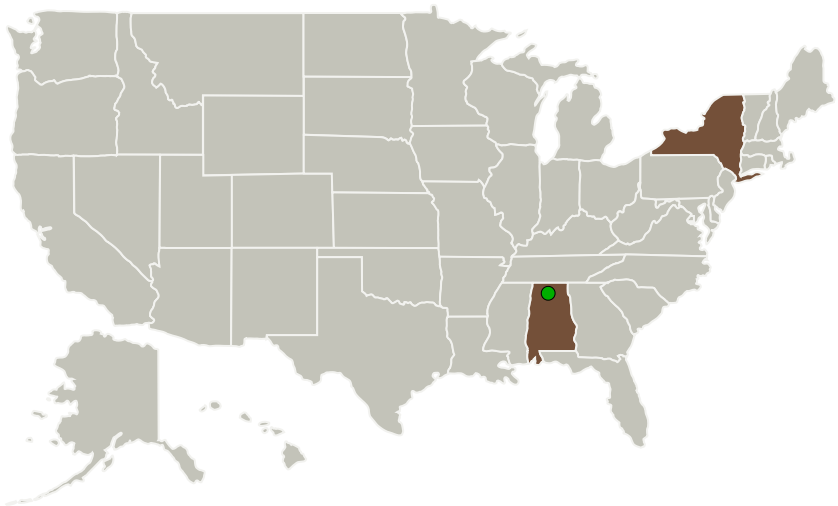
Additive Manufacturing for Lightweight Reflective Optics, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Our proposed innovation is additive manufacturing for the production of lightweight mirror substrates for flight applications with high mechanical stability. The steps of our proposed process for manufacturing lightweight 3D printed mirrors: first, a geometrically complex substrate is easily and cost-effectively manufactured using 3D printing. After printing, the mirror surface is lapped and polished using traditional manufacturing methods to final figure specifications. Then, a flight or space ready mirror coating is applied to the surface and the part is tested for performance. Additive manufacturing will permit lightweight mirrors with support structures that are impossible with traditional manufacturing methods for lightweighting. In addition, these structures will be optimized in size, shape, and location to negate thermal effects from changes in temperature and mechanical effects from stresses during manufacture, mounting, and flight. Technical Objective 1: Demonstrate feasibility of additive manufacturing a lightweight substrate with mechanical and thermal stability at flight temperatures Our goal for this objective is to manufacture a spherical mirror substrate suitable for light focusing applications at a range of temperatures for flight applications Technical Objective 2: Demonstrate feasibility of depositing mirror coatings at low temperatures for flight applications A low temperature deposition process minimizes shape distortion of the 3D-printed substrate that would occur during a typical coating. Our work plan consists of the following tasks: 1: Mirror Substrate Design and Optimization 2: Manufacturing of the Optimized Mirror Substrate using 3D printing 3: Polishing the Mirror Substrate 4: Low-Temperature Deposition of Mirror Coatings on Substrates for Flight Applications

Primary U.S. Work Locations and Key Partners



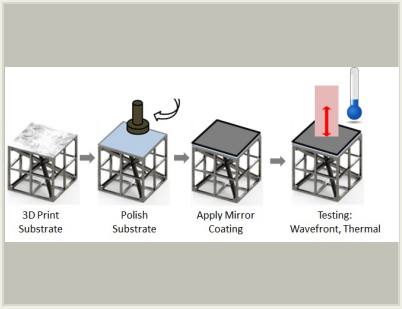


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Optimax Systems, Inc.	Lead Organization	Industry	Ontario, New York
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	New York

Project Transitions

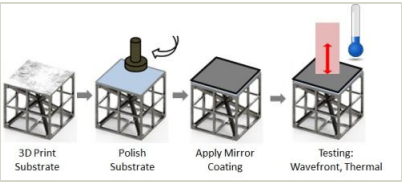
June 2015: Project Start

December 2015: Closed out

Closeout Summary: Additive Manufacturing for Lightweight Reflective Optics, Phase I Project Image

Closeout Documentation:
- Final Summary Chart Image*(https://techport.nasa.gov/file/138776)*

Images



Briefing Chart Image
Additive Manufacturing for Lightweight Reflective Optics, Phase I
(https://techport.nasa.gov/image/129950)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Optimax Systems, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

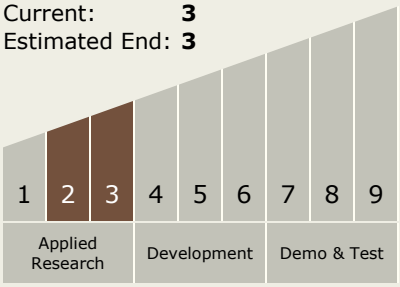
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Matthew Brunelle

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System